THE CLAIMS

What is claimed is:

1. A method of making a single crystal M*N article, including the steps of:

   providing a substrate of material having a crystalline surface which is epitaxially compatible with M*N,

   depositing a layer of single crystal M*N over a surface of the substrate; and

   removing the substrate from the layer of single crystal M*N while the crystal is close to the growth temperature, to recover the layer of single crystal M*N as a single crystal M*N article.

2. A method according to claim 1, wherein the substrate of crystalline material is formed of a material selected from the group consisting of silicon, silicon carbide, and gallium arsenide, and the substrate is etchably removed from the layer of single crystal M*N at or near the growth temperature, by etching of the substrate using a gas which etches the substrate material but does not etch the single crystal M*N material.

3. A method according to claim 1, wherein the layer of single crystal M*N is deposited directly on said surface of the substrate.

4. A method according to claim 1, wherein an intermediate layer of epitaxially related crystalline material is formed directly on said surface of the substrate, and the layer of single crystal M*N is deposited directly on an upper surface of the intermediate layer.

5. A method according to claim 4, wherein the intermediate layer of epitaxially related crystalline material comprises a protective layer deposited thereon prior to growth of the M*N layer, so that the protective layer will prevent decomposition of the single crystal substrate while M*N growth is proceeding.

6. A method according to claim 4, wherein the intermediate layer of epitaxially related crystalline material is formed either in situ or ex situ.

7. A method according to claim 4, wherein the intermediate layer of epitaxially related crystalline material includes an etch stop layer.

8. A method according to claim 1, wherein the substrate material comprises a material selected from the group consisting of silicon, silicon carbide, gallium arsenide and sapphire. $MgAl_2O_4$, MgO, $ScAlMgO_4$, $LiAlO_2$, $LiGaO_2$, ZnO. graphite, glass. M*N. SiO_2, twist-bonded substrate structures, silicon-on-insulator (SOI) substrates. compliant substrates. and substrates containing buried implant species.

9. A method according to claim 4, wherein the intermediate layer of epitaxially related crystalline material comprises a strained layer superlattice comprising from 5 to 100 alternating monolayers of two materials selected from the group consisting of AlN. InN, GaN and alloys of SiC with one or more of AlN, InN, and GaN.

10. A method according to claim 1, wherein the substrate has a similar thermal coefficient of expansion to the M*N layer.

11. A method according to claim 1, wherein the substrate crystalline material or a component of the substrate crystalline material is diffused out of the substrate into the M*N layer. for incorporation of the substrate crystalline material or a component thereof in the M*N layer as a dopant thereof.

12. A method according to claim 11, wherein the substrate crystalline material comprises silicon and wherein the silicon substrate is etchably removed with HCl gas to yield the M*N layer having a silicon-doped M*N surface region for formation of ohmic contacts thereon.

13. A method according to claim 1, wherein the layer of single crystal M*N comprises a GaN layer.

14. A method according to claim 1. wherein the layer of single crystal M*N comprises an MGaN layer, wherein M is a metal compatible with Ga and N in the composition MGaN. and the composition MGaN is stable at standard temperature and pressure (25°C and 1 atmosphere pressure) conditions.

15. A method according to claim 14, wherein M is selected from the group consisting of Al and In.

16. A method according to claim 1, where M*N is selected from the group consisting of GaN. SiC and alloys of SiC with one or more of AlN, GaN and InN.

17. A method according to claim 1, wherein hydrogen is implanted in the substrate, so that during the deposition of M*N on the substrate, the hydrogen causes *in situ* fracture of the substrate to separate the substrate from the layer of M*N.

18. A method according to claim 1, where the single crystal M*N layer comprises a compositionally graded ternary metal nitride selected from the group consisting of AlGaN. InGaN, and AlInN.

19. A method according to claim 1, where the single crystal M*N layer is doped.

20. A method according to claim 19, wherein the single crystal M*N layer is doped with a dopant selected from the group consisting of Si. Ge. S. Se. Mg, Zn. Be, V. and Fe.

21. Bulk single crystal M*N.

22. Bulk single crystal GaN.

23. Bulk single crystal MGaN, wherein M is a metal compatible with Ga and N in the composition MGaN, and the composition MGaN is stable at standard temperature and pressure (25°C and 1 atmosphere pressure) conditions.

24. Bulk single crystal MGaN according to claim 23, wherein M is selected from the group consisting of Al and In.

25. Bulk single crystal MM'GaN, wherein M and M' are metals compatible with Ga and N in the composition MM'GaN, and the composition MM'GaN is stable at standard temperature and pressure (25°C and 1 atmosphere pressure) conditions.

26. A bulk single crystal M*N article of cylindrical or disc-shaped form wherein the diameter is at least 200 micrometers and the thickness is at least 1 micrometer.

27. A bulk single crystal M*N article of cylindrical or disc-shaped form. having a thickness of at least 100 micrometers and the diameter is at least 2.5 centimeters.

28. A bulk single crystal M*N article according to claim 21, wherein the bulk single crystal M*N comprises a surface having a microelectronic device structure or substructure formed thereon.

29. A bulk single crystal M*N article according to claim 21, comprising a doped surface region.

30. A bulk single crystal M*N article according to claim 29. wherein the doped surface region comprises silicon-doped M*N.

31. A bulk single crystal M*N article according to claim 30. wherein the silicon-doped surface region has an ohmic contact structure fabricated thereon.

32. A bulk single crystal M*N article according to claim 21. where the single crystal M*N comprises a compositionally graded ternary metal nitride selected from the group consisting of AlGaN. InGaN, and AlInN.

33. A bulk single crystal M*N article according to claim 21. wherein the single crystal M*N is doped with a dopant selected from the group consisting of Si, Ge. S. Se. Mg, Zn. Be, V. and Fe.

34. A bulk single crystal M*N article according to claim 21, wherein the single crystal M*N is n-doped.

35. A bulk single crystal M*N article according to claim 21, wherein the single crystal M*N is p-doped.

36. A bulk single crystal M*N article according to claim 21. wherein the single crystal M*N is semi-insulatively-doped.

37. A microelectronic structural assembly, comprising a bulk single crystal GaN substrate having fabricated thereon a microelectronic device or a device precursor structure thereof.

38. A microelectronic structural assembly according to claim 37, comprising a microelectronic device selected from the group consisting of LEDs, lasers, detectors, and transistors, and device precursor structures thereof.